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PROFILE AND TRENDS IN FTA APPROACHES: A BIBLIOMETRIC ANALYSIS OF SPECIAL ISSUES OF INTERNATIONAL JOURNALS FROM FOUR FTA CONFERENCES

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1 Abstract

The aim of this paper is to present the profile and trends of the academic discipline of Future-oriented Technology Assessment (FTA) and its approaches. As such the paper contributes to the discussion on the concept and positioning of FTA. The paper is based on bibliometric analyses of the special issues of five international journals published after the FTA conferences in 2004, 2006, 2008 and 2011: TFSC, Futures, TASM, SSP and Foresight. Methodologically the paper draws on the facilities of Elsevier's Scopus and Thompson Reuter's Web of Science. The paper concludes that the field of FTA or foresight seems to be remarkable stable over the latest decade. As an academic field FTA has focussed its publications in a small number of journals, and that helps define and focus the field further. Finally, the paper concludes, that special issue publications resulting from the FTA conferences have the same level of quality and impact as articles published in ordinary issues of these journals.

Keywords: Foresight, FTA, trends, bibliometrics

2 Introduction

Approaches and processes for dealing with the futures of science, technology and the society have been around for several decades (e.g. Dalkey & Helmer, 1962; Irvine & Martin, 1984; Jantsch, 1967). Parallel with the establishment of Future-oriented Technology Assessment (FTA) or foresight as an area of practice in public policy development and enterprises' strategic planning, FTA foresight is also developing into an academic discipline. The publication, "Toward a new Knowledge Area" from Norway's Research Council, states that foresight in Norway during the period 2003 to 2009 has developed qualitatively from a "competence milieu" to a "knowledge area" (Norwegian Research Council, 2010). Most academic foresight literature is descriptive or normative and relates to the practice of foresight (Miles, n.d.) and it is generally acknowledged that there is a gap between practice and theory in foresight (Barré & Keenan, 2008; Hideg, 2007). This has spurred a search for a more solid theoretical foundation and in possible 'theoretical underpinnings' of the academic field of FTA or foresight (Andersen & Andersen, 2014; Fuller & Loogma, 2009; Weber, Schaper-Rinkel, & Butter, 2009; Öner, 2010).

In a contribution to science sociology, Andrew Abbott has suggested that '*..an academic discipline, or field of study, is a branch of knowledge that is taught and researched at the college or university level. Disciplines are defined (in part), and recognized by the academic journals in which research is published, and the learned societies and academic departments or faculties to*

which their practitioners belong‘ (Abbott, 2001). Following this definition FTA – or foresight - has many of the attributes of an academic discipline.

First, an increasing number of graduate studies in FTA, forecasting, foresight and similar are offered throughout the world – for example, in Australia, USA, Canada, Finland and Norway. Courses for practitioners are found in many more countries, such as a course offered regularly by Manchester Business School.

Second, academic departments with terms like foresight, technology assessment or forecasting can be found at several universities and research centres. The most important research milieus are naturally found in countries like Great Britain, Finland and Germany, which have large and longer-lasting public foresight programmes.

Third, several journals have FTA and foresight as a core area. A complete search in SCOPUS on ‘articles’ published in 2013 or earlier and including the word ‘foresight’ in titles, abstracts or as keyword gave 2,401 hits. A part of these articles have been published in economic journals such as Journal of Economic Dynamics and Control, Journal of Economic Theory, and Economics Letters. Excluded these economics oriented journals, the top-10 journals in the area are depicted in figure 1. From this can be seen, that foresight seems rapidly to increase its awareness in academic publishing with more than a quadrupling of the academic output over the latest decade. Two non-English language journals are present in the Top-10 list: the French “Futuribles Analyse Et Prospective” and the Russian “Foresight Russia”. Furthermore, it is in this context worth noticing that the journal ‘Journal of Futures Studies’ is based in Taiwan. Apart from this the leading journals – understood as the journals most frequently publishing articles with the term “foresight” in title, abstract or keywords - are Futures, Technological Forecasting and Social Change (TFSC), Foresight, International Journal of Foresight and Innovation Policy, Technology Analysis and Strategic Management (TASM), Science and Public Policy (SPP), and International Journal of Technology Management.

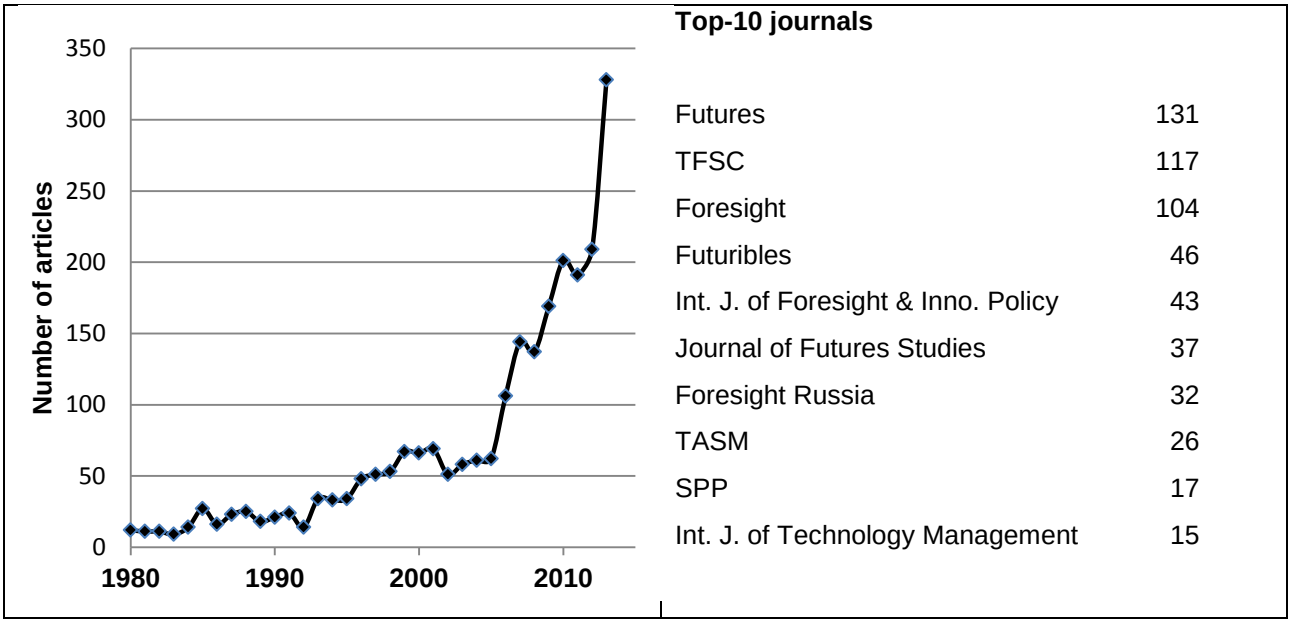

Figure 1. Development of articles from 1980 to 2013 with the word ‘Foresight’ in title, abstract or keyword and the Top-10 journals in which these articles were published – including the number of articles in each journal. Source: SCOPUS.

Fourth, there seems to be no "*learned societies*" targeting FTA or Foresight in particular. However, international conferences within technology and innovation management have established special sessions on FTA and foresight (e.g. the ISPIM conferences). A few international conferences specifically target FTA; e.g. this conference that has been arranged four times since 2004. Hence, the FTA conferences have played an important role in formalizing this research community in the absence of a "*learned society"*. According to the call for the 2014 conference, these conferences have provided "…*a common platform for the closely related communities of foresight, forecasting and technology assessment, where experts interact and help in guiding strategy, policy and decision-making to anticipate and shape future developments*".

This sets the stage for the aim of this paper: to analysing the role of the FTA conferences in shaping the academic platform for the closely related communities of foresight, forecasting and technology assessment and to present a profile and some trends with this community.

2.1 Trends in FTA and foresight

Several studies have described the development of foresight during recent decades (Georghiou, 2001; Miles, Harper, Georghiou, Keenan, & Popper, 2008; Miles, n.d., 2010). Many of these studies might have a tendency to focusing on the development in the Anglophone part of the world (i.e. UK, USA, Canada, New Zealand, Australia) and less on the trends and developments elsewhere. But despite such national differences there is no doubt about that the practice of foresight has developed well beyond the bounds of technology foresight (Butter, Brandes, Keenan, & Popper, 2008).

In this paper we will focus on a few of the trends in FTA and Foresight.

First, FTA and foresight has changed from focusing on intra-organisational planning and forecasting in science and technology to put more emphasis on open and inter-organisational "strategizing" with inclusion of external stakeholder opinions on alternative futures (Könnölä, Smith, & Eerola, 2009). This means less predictive methods and more user engagement or participative methods and more 'alternative scenarios' methods in the FTA practice (Georghiou & Cassingena Harper, 2011).

Second, FTA and foresight seems to be experiencing a 'systems turn', taking a more systemic approach both in its practice and in its understanding of innovation (Andersen & Andersen, 2014; Atilla Oner & Saritas, 2005; Saritas, 2011). This turn can be seen as implementing the systemic and evolutionary understanding of innovation that is dominant in the academic field of Innovation Studies (Dosi, 1988; Martin, 2014).

Third FTA and foresight is said to take a less national approach and more regional or sectoral approach (Georghiou, Harper, & Scapolo, 2011). FTA has broadened up its interest in policies for national innovation systems to comprise related concepts such as sectoral innovation systems (e.g Abadie, Friedewald, & Weber, 2010) and regional innovation systems and clusters (e.g Roveda & Vecchiato, 2008). The interest of FTA community in the regional level is not new but it the regional level has received increasing attention in recent years, both from the wider innovation system community (e.g. Asheim et al, 2013; Cooke, 2012) and from policy-makers.

3 Data and methodological approach

The analyses are based on articles in five international journals published after the FTA conferences in 2004, 2006, 2008 and 2011: Technological Forecasting and Social Change (TFSC), Technology Analysis & Strategic Management (TASM), Science and Public Policy (SPP), Futures and Foresight. In addition to the mentioned special issues the FTA seminar in 2006 also

resulted in a book with 11 articles published by Springer Verlag. The latter is not included in this study. In total 92 articles in the five journals were included in the analysis. See table 1.

Methodologically the paper draws on the facilities of Elsevier's Scopus and Thompson Reuter's Web of Science. Methodological support has been provided by Scopus' back-office user assistance.

Table 1 Overview of the special issues forming the empirical foundation for the analysis.

	2004	2006	2008	2011
Book on Springer Verlag[1]		12 articles, pp1-169 (2008)		
TFSC	8 articles in Vol.72, No.9, pp1059-1174 (2005)	7 articles in Vol.75, No.4, pp457-582 (2008)	9 articles in Vol.76, No.9, pp1135-1260 (2009)	9 articles in Vol.80, No.3, pp379-470 (2013)
TASM			6 articles in Vol.21, No.8, pp915-1001 (2009)	8 articles in Vol.24, No.8, pp729-861 (2012)
SPP			7 articles in Vol.37, No.1, pp3-78 (2010)	12 articles in Vol.39, No.2, pp140-270 (2012)
Futures			8 articles in Vol.43, No.3, pp.229-356 (2011)	7 articles in Vol.59[2], pp1-72 (2014)
Foresight				6 articles in Vol.14, No.4, pp279-351 (2012) 5 articles in Vol.15, No.1, pp6-73 (2013)
Total number of articles analysed in this paper	8	7	30	47

4 Results

4.1 Trends in academic underpinning and focus of FTA

Above we cited Andrew Abbott for the statement that academic fields are defined (in part) by the academic journals in which research is published (Abbott, 2001). That leads to the statement that academic underpinning of an academic field in part is defined by the journals that are referred to in that field.

In this section we have analysed the references in the 12 special issues and compared these with the general reference profile of the journals as presented in the Journal Citation Report by Thompson Reuter's ISI Web of Science. See table 2.

The right hand column in table 2 shows the number of times articles published in each of the mentioned journal (in all years) was cited in 2013. The result is based on a search in the Journal Citation Report by Thompson Reuter's ISI Web of Science. We have analysed data for the four

[1] Not included in this analysis.
[2] Futures has change volume/issue system, and do not use issue numbers.

of the five journals in which special issues from the FTA conferences have been published. That is TFSC, TASM, SPP and Futures. The journal Foresight is not indexed by Web of Science.

The left hand and middle column in table 2 show how many times articles specific journals were referred to in articles in the FTA special issues. As only one special issue was published after the FTA conferences in 2004 and 2006 we have merged the articles from these two conferences with the output from the 2008 conference. Hence we got two comparable populations with 45 articles from the FTA conferences in 2004, 2006 and 2008 and 47 articles from the FTA conference in 2011.

Table 2 Analysis of journals in the field of FTA and foresight. Numbers are only comparable within each square in the table.

	Special issues from FTA conferences 2004, '06 & '08		Special issues from FTA conferences 2011		Journal in general all years (WoS data)	
TFSC	Foresight	64	Futures	30	TFSC	696
	TFSC	46	TFSC	26	Research Policy	233
	Futures	30	Foresight	21	Futures	141
	Research Policy	20	Nanotechnology	19	Strategic Management J	136
	Nature	8	Research Policy	10	Technovation	128
	Nanotechnology[3]	7	Nature	3	Energy Policy	109
	Eur. J. Oper. Res.	3	Eur. J. Oper. Res.	2	Adm. Science Quarterly	76
	Int. J. Foresight Innov. Policy	3	Int. J. Foresight Innov. Policy	2	Management Science	74
	Management Science	3	Technovation	2	Harvard Bus. Rev.	72
	Research Evaluation	3	Scientometrics	1	Acad. Management Rev.	72
TASM	Foresight	44	Foresight	21	Research Policy	237
	Futures	12	Futures	21	TASM	185
	TFSC	10	TFSC	14	Strategic Management J	106
	Journal of Forecasting	5	Strategic Management	8	TFSC	96
	Research Policy	4	Research Policy	6	Technovation	94
	SPP	3	SPP	5	R&D Management	69
	TASM	3	Energy Policy	4	Organization Science	51
	Long Range Planning	2	Long Range Planning	4	Acad. Management Rev	45
	Futures Research Quarterly	1	Technovation	4	Ind. and Corp. Change	41
	Organization Science	1	Adm. Science Quarterly	3	Energy Policy	40
SPP	Foresight	22	Foresight	43	Research Policy	137
	Futures	7	Futures	26	SSP	121
	Research Policy	6	SPP	20	Sci. Tech. & Human Values	35
	SPP	5	TFSC	19	Environ. Science Policy	30
	TFSC	2	Research Policy	18	Public Understand. of Sci.	27
	Journal of Forecasting	1	Long Range Planning	4	Futures	24
	Management Science	1	Nature	3	Nature	23
	Nanotechnology	1	TASM	3	Social Studies of Science	23
	n.a.		Organization Science	2	TFSC	23
	n.a.		Sci. Tech. & Human Values	1	Science	22
Futures	Foresight	52	Foresight	28	Futures	299
	TFSC	21	Futures	18	TFSC	84
	Futures	17	TFSC	9	Nature	34
	Research Policy	6	R&D Management	6	Foresight	30
	Journal of Forecasting	4	SPP	6	Energy Policy	28
	SPP	4	Management Decision	4	J Futures Studies	27
	Energy Policy	2	TASM	4	Long Range Planning	24
	Management Science	2	Management Science	2	Harvard Bus. Rev.	23
	Nanotechnology	2	Research Policy	2	Ecological Economics	22
	Industrial and Corp. Change	1	Adm. Science Quarterly	1	Global Environ. Change	21

The result in table 2 has come about by exporting all references in articles published in the special issues and then sorting them according to a gross list of potential journals. This sorting has

[3] Nanotechnology might cover more than one journal with the same name.

sought to take into account differences in the notation of the individual journal in the reference lists. For example: “Technological Forecasting and Social Change”, “TECHNOL FORECAST SOC”, and “TFSC” refers to the same journal. Only the top-10 cited journals for each of the four journals are listed in table 2.

The following observation can be made from table 2. First, the right hand column shows that articles in general in the four journals refer to high quality (measured as their Journal Impact Factor) journals such as Research Policy, Strategic Management Journal, Technovation, Science Technology and Human Values, Administrative Science Quarterly, and Nature.

Secondly, references to “sector journals” such as Energy Policy, Environment Science Policy, Ecological Economics, and Global Environmental Change indicate that energy and environment are important research domains for research published in these four journals.

Third, it seems as publications from the FTA conferences refer to a more coherent set of journals than the four journals in general. Articles in the three journals Foresight, Futures and TFSC are regularly the most cited across all four journals.

Fourth, the journal Research Policy is present in the top-10 list of cited journals in all four FTA outlets. This probably mirrors that articles in Research Policy also is among the top-2 cited journals for three of the four FTA journals in general (except Futures). It might also mirror the fact that the theoretical rationale for policy-oriented foresight exercises is supported by the perspective of evolutionary economics and the innovation systems approach (Georghiou & Keenan, 2006) and that Research Policy is acknowledged to be the leading journal in the field of innovation studies.

Fifth, it can be observed that the journal Nanotechnology is present in three of the top-10 cited special issue journals from the 2004, 2006, and 2008 FTA conferences, but only once in the special issues from the 2011 FTA conference. This could mirror that the policy interest in nanotech was peaking in these years.

4.2 Trends in FTA approaches

In the following paragraph we will thrive to investigate the trends in field of FTA and foresight as indicated in section 2 of this paper. However, a study on the trends in FTA and foresight based on special issues from the FTA conferences of course has biases. The articles in the special issues do primarily reflect the choices made by the special issues editors and the members of the scientific committees. As noted in the editorial note in one of the special issues: ”*The papers … were carefully selected and further nurtured to bring out three key themes..”* (Könnölä et al., 2009). Hence, conclusions must be drawn with some caution.

The analysis of trends in FTA approaches is based on analyses of keywords and abstracts. Both keywords and abstracts of the 92 papers were extracted from an EXCEL-file exported from the search facility in SCOPUS. Unfortunately, SCOPUS was not able include keywords from SPP Vol. 37, No.1 (2010) and Futures Vol.43, No.3 (2011). This also calls for cautiousness on conclusions based on the keyword analysis.

In the special issues from the FTA conferences in 2004, ‘06 & ’08 14 of the 45 articles have keywords identifiable as FTA methods. 19 of the 47 articles from the FTA conference in 2011 have keywords – and strings of keywords - identifiable as FTA methods. See table 4. At a first glance scenario is clearly identifiable as the most popular FTA method. Scenarios are mentioned in more than the half of the articles from the 2011 conference with identifiable FTA methods.

If any trend is detectable from this keyword analysis it is that scenarios seem to have become increasingly important. However, this only partly confirmed by a similar analysis of terms in ab-

stracts in the same papers. See table 6. The term “scenario” actually is less frequent in 2011 that in the earlier versions of the FTA conference, but it appear with a double frequency in the abstracts submitted for the 2014 FTA conference.

Table 3. FTA methods appearing in keyword

Special issues from FTA conferences 2004, ‘06 & ‘08	Special issues from FTA conferences 2011
• Barometer, Indicator • Bibliometrics • Bibliometrics • Delphi • Roadmapping • Roadmapping • Robust Portfolio Modeling • Scanning process • Scenarios • Scenario planning • Scenario planning • Text mining • Trends • Visioning	• Delphi method; Scenario planning • Delphi method; Scenarios • Early warning signals; Horizon scanning; Weak signals • Exploratory Modeling and Analysis • Horizon scanning • Indicator; Patent • Key enabling technologies • Megatrends • Modeling • Roadmapping • Roadmapping; Scenarios; Vision-building • Scenarios • Scenario design • Scenario planning • Scenario planning • Scenario practice • Scenario • Scenarios; Vision; Weak signals • Visioning

We have also analysed the content of the abstracts of the 92 FTA conference papers. Furthermore, as one of the authors of this paper have had access to abstracts submitted to the 2014 version of the FTA conference these abstracts were also included in the analysis. The analysis of the abstracts was made by use of the free software Text Analyzer[4] using its function “Unfiltered Wordcount”. In the wordcount we have omitted common English words such as; “the”, “and”, “of”, and “to”. The 10 most frequent words (apart from common English words) for the three dataset are listed in table 5.

Table 4. Top-10 terms in abstracts. Numbers refer to percentage of each word in all abstracts combined.

Special issues from FTA conferences 2004, ‘06 & ‘08		Special issues from FTA conferences 2011		Abstracts submitted for the FTA 2014 conference	
foresight	1.06	foresight	1.05	foresight	0.68
research	0.67	policy	0.84	future	0.58
future	0.59	fta	0.83	technology	0.57
technology	0.56	future	0.73	research	0.52
innovation	0.47	technology	0.68	innovation	0.52
process	0.44	innovation	0.66	policy	0.42
policy	0.44	research	0.64	analysis	0.33
analysis	0.37	challenges	0.49	development	0.31
development	0.36	analysis	0.45	fta	0.29
fta	0.32	methods	0.42	process	0.24

[4] http://www.online-utility.org/text/analyzer.jsp

First, it can be observed that the term “foresight” is more frequently used that the term “FTA”. That goes for both the edited special issues from the FTA conferences and also from the non-edited abstracts for the FTA 2014 conference. The term “foresight” is actually the most frequent word apart from standard English words such as “the” and “and”.

Second, many words are on common for the three samples. Eight words are among the most frequent words in all three cases: foresight, research, future, technology, innovation, policy, analysis, and FTA. Hence, based on this material no major development or trend in the field of FTA is detectable and it indicates a quite stable approach to the field.

In order to investigate the trends in the field of foresight and FTA as described in paragraph 2 in this paper we have analysed the frequency of some selected terms in the abstracts. See table 6.

Table 5. Selected terms in abstracts. Numbers refer to percentage of each word in all abstracts combined.

Abstracts in special issues from FTA conferences in 2004, 2006, 2008		Abstracts in special issues from FTA conference in 2011		Abstracts submitted for the FTA 2014 conference	
system	0.09	systems	0.22	systems	0.21
		system	0.16	system	0.19
participatory	0.05	participatory	0.05	participatory	0.06
participation	0.09	participation	0.02	participation	0.04
national	0.21	national	0.22	national	0.13
region	0.05	regions	0.01	regional	0.06
regional	0.03			region	0.03
scenario	0.12	scenario	0.09	scenarios	0.22
				scenario	0.14

FTA and foresight is said to have taken a more systemic approach (Andersen & Andersen, 2014; Atilla Oner & Saritas, 2005; Saritas, 2011). This is confirmed by the abstract analysis. The frequency of term system(s) has more than doubled from the 2004-08 FTA conferences to the 2011 conference. The same level is observed for abstracts submitted for the FTA 2014 conference.

FTA and foresight is also said to have become more focussed on user engagement and participatory methods (Georghiou & Cassingena Harper, 2011; Könnölä et al., 2009). This trend is not confirmed in the abstract analysis. The frequency of the term “participatory” is actually quite stable in the three cases and the term “participation” have decreased from the 2004-08 FTA conferences to the 2011 FTA conference.

Finally, FTA and foresight is said to take a less national approach and more regional or sectoral approach (Georghiou et al., 2011). Also this trend cannot be supported by the abstract analysis. No clear trend can be observed in the use in the abstract of the terms “national”, “region” and related terms.

In conclusion, the attempt to use analyses of keywords and abstracts to verify generally acknowledge trends and developments within FTA and foresight was not particularly successful. The clearest observation is that the field seems to have become stable - with stability in key journals and in the use of key words.

4.3 Quality and impact of the FTA special issues

As mentioned the FTA conferences has thrived to contribute to the shaping of the academic platform of the related communities of foresight, forecasting and technology assessment. In academia such impact is often measured in citations to the publication. Quite often in academia the number of citations also is perceived as a proxy for quality. The logic is that the more citations to an article the better the quality and impact of that article. However, traditions for publications and citations vary between academic fields, and comparisons have to be made between comparable entities.

In this case we have compared citations to articles from FTA conferences published in 12 special issues with all other articles published in the journals the same year. Data download from SCOPUS was made end of October 2014. The analysis is based on a simple citation analysis and with comparisons with ordinary issues of each journal. See table 3.

The analysis was first made by a calculating a simple average of citations to articles in each journal and comparing that number with the average citations to articles in all other articles in the particular journal in the particular year. See table 3. From this simple analysis it is obvious that there is no significant difference or systematic pattern between FTA special issues and ordinary issues of the journals. In average articles in FTA special issues seems to have lesser citations (6.2) than articles in ordinary issues of the same journals (6.9). However this difference is not significant. Only significant pattern is a relationship between time since publication and number of citations. An article published in 2014 only have very few citations during the same year; probably authors' self-citations.

Table 6. Comparisons between average numbers of citations to articles published in FTA special issues and the similar number of citations to rest of the articles published in the journals the same year.

Special issue	Average citations per article for the special issues	Average citations per article of rest of the articles published in the journal that year
TFSC Vol.72, No.9, (2005)	18.3	21.5
TFSC Vol.75, No.4, (2008)	19.4	18.8
TFSC Vol.76, No.9, (2009)	11.3	17.5
TFSC Vol.80, No.3, (2013)	4.7	2.4
Foresight Vol.14, No.4, (2012)	1.0	1.5
Foresight Vol.15, No.1 (2013)	0.0	0.3
Futures Vol.43, No.3 (2011)	5.3	3.8
Futures Vol.59, (2014)	0.3	0.1
TASM Vol.21, No.8, (2009)	2.0	6.7
TASM Vol.24, No.8 (2012)	2.3	2.2
SPP Vol.37, No.1 (2010)	5.1	6.3
SPP Vol.39, No.2 (2012)	4.1	2.1
Average	6.2	6.9

The same data were exposed to a more thorough statistical analysis; a T-test with equal variances. Also this method of analysis shows no significant differences.

In conclusion, the analysis shows that 92 articles published in the 12 special issues have the same quality and impact – measured in number of citations – as articles published in these journals in general.

5 Conclusions

The aim of this paper was to present the profile and trends of the academic discipline of Future-oriented Technology Assessment (FTA) and its approaches. The paper has analysed trends in academic underpinning and focus of FTA, trends in FTA approaches, and the quality and impact of the FTA special issues.

The first conclusion is that the field of FTA or foresight seems be remarkable stable over the latest decade. As an academic field FTA has focussed its publications in a small number of journals and there seems no clear trend or development in the most important issues dealt with in the academic publications from the FTA conferences. This is not necessarily a negative situation. It rather indicates that FTA have found its framing and that could help the further definition and focussing of the field.

Next we have investigated generally acknowledge trends and developments in the FTA field; that FTA has taken a more systemic approach, that FTA has become more focussed on user engagement and participatory methods, and that FTA has taken less national approach and focus more on regional or sectoral issues. We have investigated these alleged trends by analyses of keywords and abstracts of 92 articles in international journals resulting from the earlier four FTA conferences. Only the development affiliated with a more systemic approach can be confirmed by the abstract analysis. The other developments cannot be verified. This can be due to the validity of such analyses or a bias resulting from the editing process of the special issues. This can also be due to the fact that some of the generally acknowledge developments in FTA are based on qualitative studies or "common wisdom" and not on more quantitative analyses. There seems to be a need for more detailed quantitative analyses of the development of the field of FTA.

Finally, we have investigated the quality and impact of the FTA special issues measured as citations to the articles in these special issues. This analysis concludes, that special issue publications resulting from the FTA conferences have the same level of quality and impact as articles published in ordinary issues of these journals.

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